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Pamela A. Parmal

Museum of Fine Arts, [pparmal@mfa.org](mailto:pparmal@mfa.org)

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## The Impact of Synthetic Dyes on the Luxury Textiles of Meiji Japan

Pamela A. Parmal

David and Roberta Logie Curator of Textile and Fashion Arts  
Museum of Fine Arts, Boston

[pparmal@mfa.org](mailto:pparmal@mfa.org)

As the textile historian and weaver, Akira Yamaguchi has written, the phrase “much from little” presented a model for Japanese dyers and weavers of Noh costumes during the Edo period.<sup>1</sup> The dyers prided themselves on using a limited number of dye sources and, with complex and time-consuming techniques, created a wide range of colors. The weavers then wove this rainbow of silk into ever-changing patterns. Noh costumes, such as *atsuita* (fig. 1) worn for male courtier/warrior roles, illustrate how silks dyed in shades of blue, yellow, green, pink, and purple are combined and then recombined by the weaver to mask the repeat and create a robe of strong visual presence. As the Edo-period came to a close, Japanese dyers of luxury textiles such as those used in Noh costumes were introduced to aniline dyes whose ease of use and ever-expanding color palette meant, “much from little” no longer need apply. This paper explores the impact of synthetic dyes on Edo and Meiji culture, and how the weavers and dyers, with their strongly held traditions, incorporated the new dyes into their work.



*Fig. 1 Noh theater costume, atsuita, Japanese, 1st half 19th century; Silk twill, ikat-dyed and patterned with silk and gilt-paper patterning wefts. Collection of the Museum of Fine Arts, Boston. 11.3799.*

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<sup>1</sup> Akira Yamaguchi et al., eds. *The World of Noh Costumes*. (Kyoto: Yamaguchi Noh Costume Research Center, 1989), 43.

Prior to the introduction of synthetic dyes, Japanese dyers relied on natural sources such as indigo for blue; safflower for red; gromwell for purple; betel palm, gall nuts or plum or alder bark for black and brown; and miscanthus, philodendron or gardenia for yellow. Many of these dyes were difficult to extract and the dyeing process involved multiple steps that could take a year to complete. The colors most difficult to dye—purple and red—became the colors most often associated with the aristocracy, while other colors could be worn by people of all social classes.

Purple, or *murasaki*, came from the roots of the gromwell plant. Gromwell is a flowering shrub that grows in higher altitudes. The roots are collected and dried for two to three months to mature the color. While this occurs, the silk is pre-mordanted in a bath of camellia ash, which is rich in alum. The mordanting process involves repeated immersion of the cloth or yarn in the alum bath and drying over a two- or three-month period. To prepare the dyestuff, the gromwell roots are softened overnight in 60° water and then pounded to release the dye. The silk is then repeatedly immersed in the bath, aired to allow more oxygen to penetrate the cloth and then steeped in the dye until the desired color is achieved. When the dyeing is completed the cloth is placed in dark storage for as long as a year while the color continues to mature.

The safflower plant produced yellow and scarlet, or *beni*. The petals of this thistle turn from white to yellow to red during the summer. Just before the petals turned red, they were collected. The yellow dye was extracted first and the red dye followed. It was then dried into cakes and when needed could be dissolved in an alkaline solution. During the dyeing process the cloth or yarn was repeatedly dipped until the proper color red was achieved. According to Edo period records, twelve kilograms, or 26.5 lbs., of petals were needed to dye one scarlet robe and, it could take as long as two years to process.

Of course the high cost involved in dyeing with gromwell and safflower meant that only the wealthiest and most powerful could afford to wear clothing dyed purple or scarlet. The symbolic importance of these colors increased with the introduction of Buddhism to Japan in the sixth century. Color took on symbolic meaning and became associated with rank similar to the Chinese system. Blue, red, yellow, white and black were associated with the five elements, while purple represented the perfect harmony between yin and yang. In 645, the Emperor Ko:toku reorganized and regulated the court, as well as set down a series of sumptuary regulations addressing the colors appropriate to rank. According to Ko:toku's regulations, the first and second ranks wore robes of purple; the third rank wore lavender robes; the fourth rank wore red; and the fifth rank wore navy blue. These regulations lasted barely four months, but paved the way for others issued during the Nara, Heian and Muromachi periods. During the Nara period regulations decreed that all below the rank of prince, including women, would wear, in order of rank, purple, lavender, crimson, Indian red, cherry, mulberry, dark blue, light blue, leaf green and grass green. Murasaki Shikibu writes in her Heian-period diary that she was dazzled by the presence of the Emperor and Empress as the early morning sun shone on one of the Queen's audiences. The royal couple sat on two raised platforms. The Emperor wore an outer robe of "grape-colored" brocade with an inner garment of

white and green; while the Empress wore a red outer robe with layered inner robes of purple, red, light and dark green, and two shades of yellow.<sup>2</sup>

The restriction of purple and red to the noble classes continued throughout the Heian and Muromachi periods to the middle of the sixteenth century; went out of use during the Momoyama period, and was again brought back during the Edo period when certain colors were restricted to the Imperial family and the ruling military class. In fact, when the Edo-period shogun Tokugawa Ieyasu moved to Tokyo in 1590, making it the unofficial capital of Japan, the city became known as the Purple City and, purple is still the predominant color in the city flag.

When the Edo period came to a close in 1868, the great social upheaval brought about by the dissolution of the samurai class and the more egalitarian politics of the Meiji government, meant that color no longer need be associated with social position. Coincidentally, the introduction of synthetic aniline dyes from the West meant that purple and red were now more easily produced. Despite the increasing availability and relaxation of sumptuary legislation, synthetic dyes do not appear to have revolutionized the work of the Japanese dyers, nor the color of Japanese dress, nor the symbolic importance of colors such as purple and scarlet until very late in the Meiji era.



Fig. 2. Kojima Shogetsu, Japanese (1870-1900). *Illustration of the Principal Dignitaries of Japan, January 1891*. Ink and color on paper. Collection of the Museum of Fine Arts, Boston 2000.530.

Of course, the fact that the first aniline dye invented was purple, which had always been associated with wealth and power, did not hinder its quick adoption throughout the world. Aniline purple, or mauve, was invented by William Henry Perkin in 1856 and quickly put into production. It was shortly thereafter introduced to Japan, when in 1859 a synthetic dye shop was opened in Kyoto by a foreign firm and, by 1862, the Japanese dyer who specialized in purple, Izutsuya Tadasuke, began to incorporate synthetic dyes

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<sup>2</sup> Murasaki Shikibu, "The Diary of Murasaki Shikibu," translated by Annie Shepley Omori and Kochi Doi in *Diaries of Court Ladies of Old Japan*. (Boston and New York: Houghton Mifflin Company 1920), 144.



into his work.<sup>3</sup> These early dyes found use among woodblock printers as well as dyers but, because they were expensive, were not widely adopted until the Meiji period. Many Meiji-period wood block print artists eventually incorporated the dyes into their work and, bright purple and red are often seen in prints, however, the symbolism is often contradictory. Prints incorporating aniline dyes, especially red and purple came to be known as “red” prints and are characteristic of the propaganda works associated with the emperor Meiji and his family. A print by Kojima Shogetsu shows the principal dignitaries of Japan. (fig. 2) The Emperor and Empress sit in the center and are surrounded by red and purple furnishings. It is interesting to note that while the empress wears typical western dress, it is still purple and red. While the use of red and purple strongly suggest Imperial connections, the colors were spreading and took on a new political meaning. An Utagawa Hiroshige triptych from 1874 titled “Scenic View of Tokyo Enlightenment: Prosperity of Brick and Stone Shops on Both Sides of Ginza Street” shows how the colors have spread among the “enlightened” citizens of Tokyo who almost uniquely wear purple, red, and blue (fig. 3).

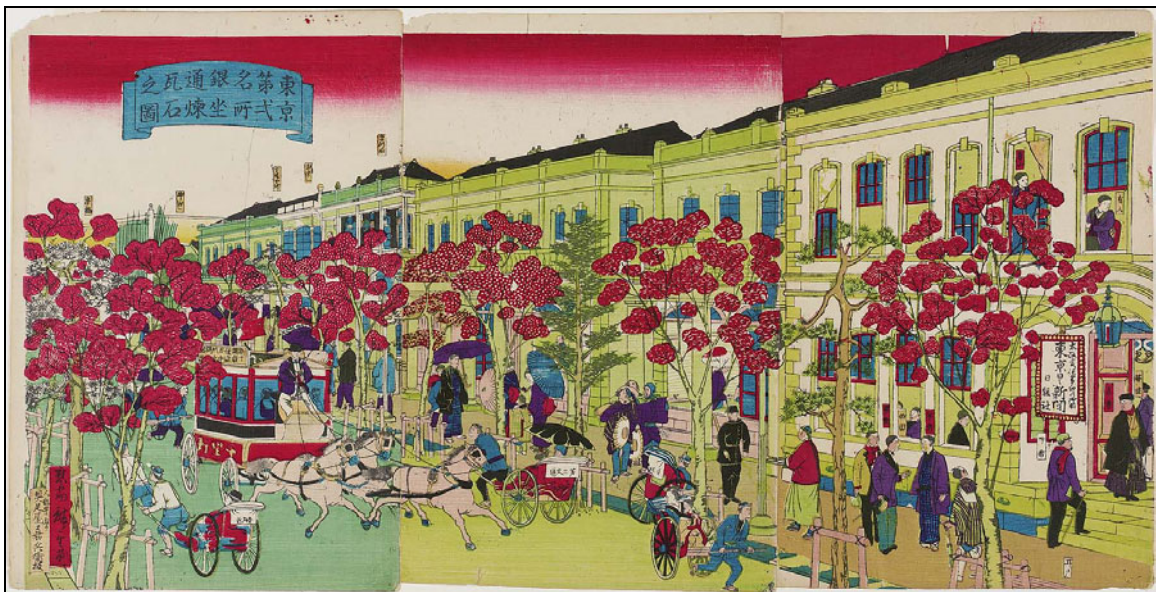


Fig. 3. Utagawa Hiroshige III. *Japanese* (1842-1894). *Scenic View of Tokyo Enlightenment: Prosperity of Brick and Stone Shops on Both Sides of Ginza Street*. 1874. Ink and color on paper. Collection of the Museum of Fine Arts, Boston. 2000.388.

While the aniline purple and red were still identified with class, the brilliant new aniline colors from the West also signified the Meiji government’s support of Western technology and innovation. In fact, one writer referred to chemical dyes as “the colors of progress”<sup>4</sup> and a political cartoon that appeared in the January 25, 1879 edition of the newspaper, the *Marumaru Shimbun* depicted a Western Dye Shop with two potential customers outside. As the shop owner cries out, “Come on—please bring in as much as you can!,” one perspective customer exclaims, “In my heart I don’t want to be dyed, but

<sup>3</sup> *Kyo-no Yuzen-shi*. (Kyoto Yuzen Kyodokumaiai, 1992).

<sup>4</sup> Amy Reigle Newland. *Time Present and Time Past: Images of a Forgotten Master, Toyohara Kunichika 1835-1900*. (Leiden, Hotei Publishing, 1999), 19.

if I don't get to be a popular color, how will I succeed?"<sup>5</sup> The cartoon captures the pressure placed on the Japanese by the Meiji government to modernize according to Western standards—and the use of aniline dyes was just one of many new technologies encouraged.

The Japanese textile industry and chemical industry, which started by focusing on synthetic dyestuffs and fats and oils, were two of the earliest Japanese industries to modernize. In 1870, two years after the Meiji restoration, the Japanese Chemistry Bureau was founded and English and German chemists were invited to establish the first chemistry department at Tokyo University as well as a fledgling chemical industry. In 1873, several dyers were sent to Osaka from the Chemistry Bureau to learn the craft of black dyeing from the English dyers practicing in that city. Others dyers were sent to Europe where they were introduced to the industry in both Lyon and Germany, and by 1875 the Somedono, or Dyeing Palace was established in Kyoto to teach the use of synthetic dyes to anyone who wanted to learn. By 1776, the Japanese dyers had incorporated synthetic colors into their trade. A Japanese sample book put together for the 1876 Philadelphia Centennial Exhibition, later purchased by the Museum of Fine Arts, Boston, illustrates a number of brightly-dyed textiles many of which were probably dyed with synthetic purple and red.<sup>6</sup> (fig. 4) Japan also began to import dyes in prodigious quantities. By 1885, almost 450,000 yen worth of dyestuffs (both chemical and natural) were imported from English, Swiss, French and German manufacturing centers. England was the biggest exporter, shipping dyes worth over 162,000 yen, with Germany second at over 122, 000 yen.<sup>7</sup>

The textile sample book from the Philadelphia Centennial indicates that dyers and weavers incorporated the new dyes into their existing traditions. The Official Guide to the Japanese pavilion at the Centennial confirms this and mentions that synthetic dyes, primarily those soluble in water, were quickly imported in considerable quantity and replaced the more difficult natural dyes.<sup>8</sup> Those yarns dyed with anilines were incorporated into textiles woven for the newly constructed Imperial Palace in Tokyo, as well as into Noh costumes, which were again being woven. In 1878, the Empress Dowager commissioned Kyoto weavers to make the costumes as a way to support them and the Noh troupes that were just beginning to regroup after losing the financial support of the samurai class and the state at the end of the Edo period.

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<sup>5</sup> Julia Meech-Pekarik, *The World of the Meiji Print: Impressions of a New Civilization*. (New York: Weatherhill 1986), 183.

<sup>6</sup> The sample book (MFA 76.463a,b) was purchased by the Museum's first curator Charles Loring when he visited the Philadelphia Centennial Exhibition in 1876. It was made by order of the Japanese government and featured silks woven in Kyoto.

<sup>7</sup> Johann Justus Rein, *The industries of Japan*, (New York: A.C. Armstrong, 1889), 549.

<sup>8</sup> Imperial Japanese Commission to the International Exhibition. *Official catalogue of the Japanese section and descriptive notes on the industry and agriculture of Japan*. (Philadelphia), 1876, p. 80.

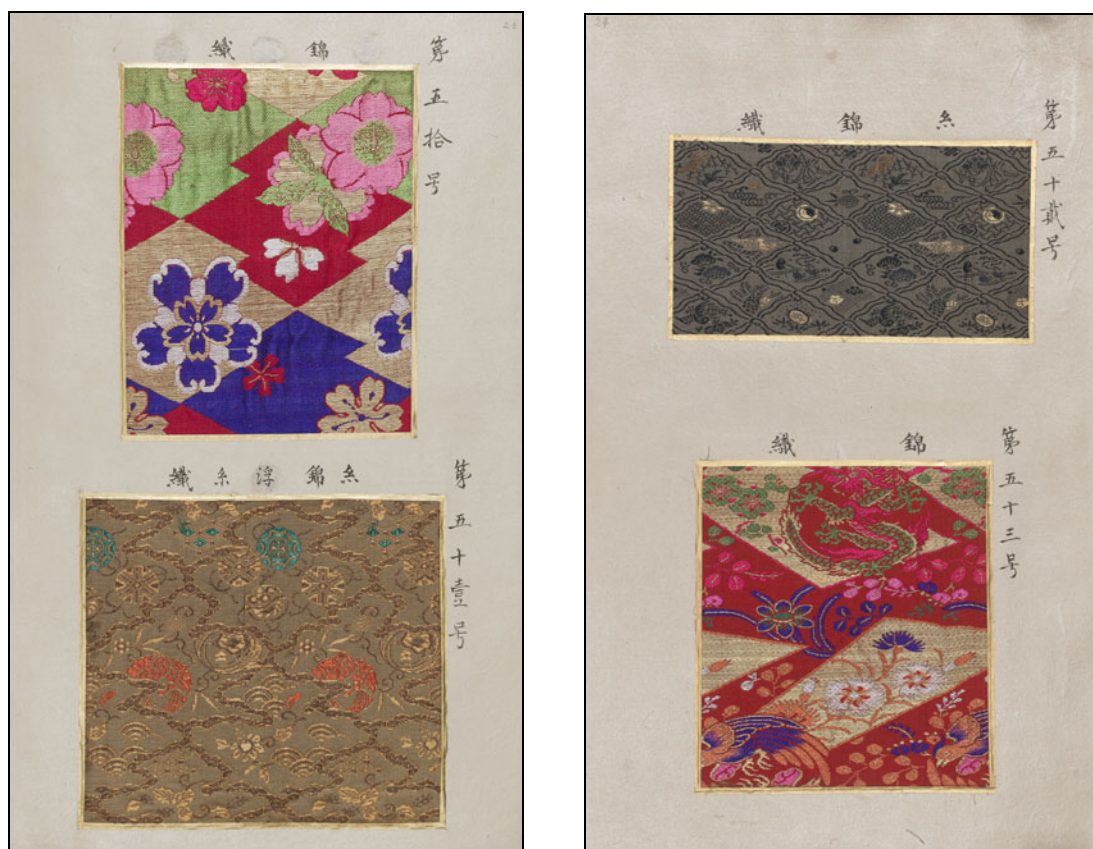


Fig. 4 Two pages from Japanese silk sample book prepared for the Philadelphia Centennial Exhibition in 1876. Collection of the Museum of Fine Arts, Boston 76.463a,b.

The Meiji-era Noh costumes in the Museum of Fine arts show the continuation of traditional dyeing practices; however, while some weavers continued the follow set color schemes, others began to experiment with the new aniline colors choices. Some *atsuita* reflect traditional styles and, aniline dyes are used as a replacement for the natural dyes that produced similar color and not to introduce a new color scheme. These dyes were also modified to create different colors and hues as was typical of traditional practices.

Several of the dyes used in the robe in the MFA's Meiji-period Noh costumes have been analyzed using a high performance liquid chromatography, or HPLC, instrument. In this test, the dye is extracted from a very small fiber sample, usually taken from loose wefts on the back of the robes. The HPLC instrument then separates the compounds used to make up the dye and measures the ultra-violet/visible light absorption level of each compound. This information is then graphed on a chart, which indicates the rate of light absorption over time. This chart can then be compared to known samples and the chemical nature of the unknown dye determined.

Richard Newman, the MFA's conservation scientist, is performing the HPLC tests and establishing standards based on samples of historic synthetic dyes left with the Getty Conservation Institute by the dye chemist and historian Helmut Schweppe. Newman is also analyzing fibers from tufted samples included in the book *Couleurs d'Aniline de la Badische Anilin- & Soda-Fabrik* published in 1901.





Fig. 5 Noh theater costume, *atsuita*; Japanese, late 19th century; silk twill, ikat-dyed and patterned with silk and gilt-paper patterning wefts; Collection of the Museum of Fine Arts, Boston 11.3830.

Some robes in the collection indicate how weavers were breaking away from tradition and exploiting the new colors in their work. Several *atsuita* from the MFA's collection demonstrate a new bright color palette such as the *atsuita* in figure 5. Male actors wore the *atsuita* as an under robe and it was often patterned with strong geometric and Buddhist motifs that exemplified the strength and dignity of the character. The MFA's robe maintains the standard *atsuita* iconography but with a new brilliant color palette that is jarring to most people's eyes. In fact, curators at the MFA refused to exhibit these robes until recently as they were not seen as a reflection of Japanese taste. However, if robes such as this were worn at the inaugural performance of the new Noh theater built in Tokyo Park in 1881, which was attended by the Dowager Empress and 200 of the highest ranking men and women in Japan, they would have been a powerful statement of Japan's ability to adapt Western technology to their own traditions.

Another example of weavers' experimentation is found in the fortuitous survival of two identically patterned Noh costumes, one from the 18th century and now in the collection of the Los Angeles Museum of Art, and another from the Meiji period, and



now in the collection of the MFA, Boston (fig. 6).<sup>9</sup> Both *karaori* robes have red grounds, the LACMA robe was dyed with safflower, while the dye used in the MFA robe is most likely synthetic, but has not yet been identified. The colors used in the LACMA robe camellia vine are subdued compared with the Meiji-period robe, with white, red and pale yellow camellias and leaves of a more dramatic color palette including blues, greens, and purple. This color scheme contrasts sharply with the camellias woven into the Meiji-period robe that show a riot of color such as purple, teal blue, turquoise, orange, gold, pink, and fuchsia, while the leaves are more subdued and show variations on green. HPLC tests indicate that methyl violet and dyes related to Magenta and Safranine were used. What is of note is that the dark purple and teal blue colors were both created using methyl violet. The graph for the dark purple shows an almost identical match to the methyl violet sample in the BASF book. The teal blue graph shows the presence of methyl violet but also reveals a presence of additional compounds used to create the new color. The HPLC tests also show that the fuchsia and pink silk used in the robe were dyed using safranine T in different combinations.



*Fig. 6 Noh theater costume, karaori, (detail); Japanese, late 19th century; Silk twill with supplementary silk and gilt-paper patterning wefts; Collection of the Museum of Fine Arts, Boston 11.3846.*

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<sup>9</sup> An illustration of the LACMA robe (M.2002.71.1) can be found in Sharon Takeda, *Miracles & Mischief: Noh and Kyogen Theater in Japan*. (Los Angeles: Los Angeles County Museum of Art, 2002), 136.

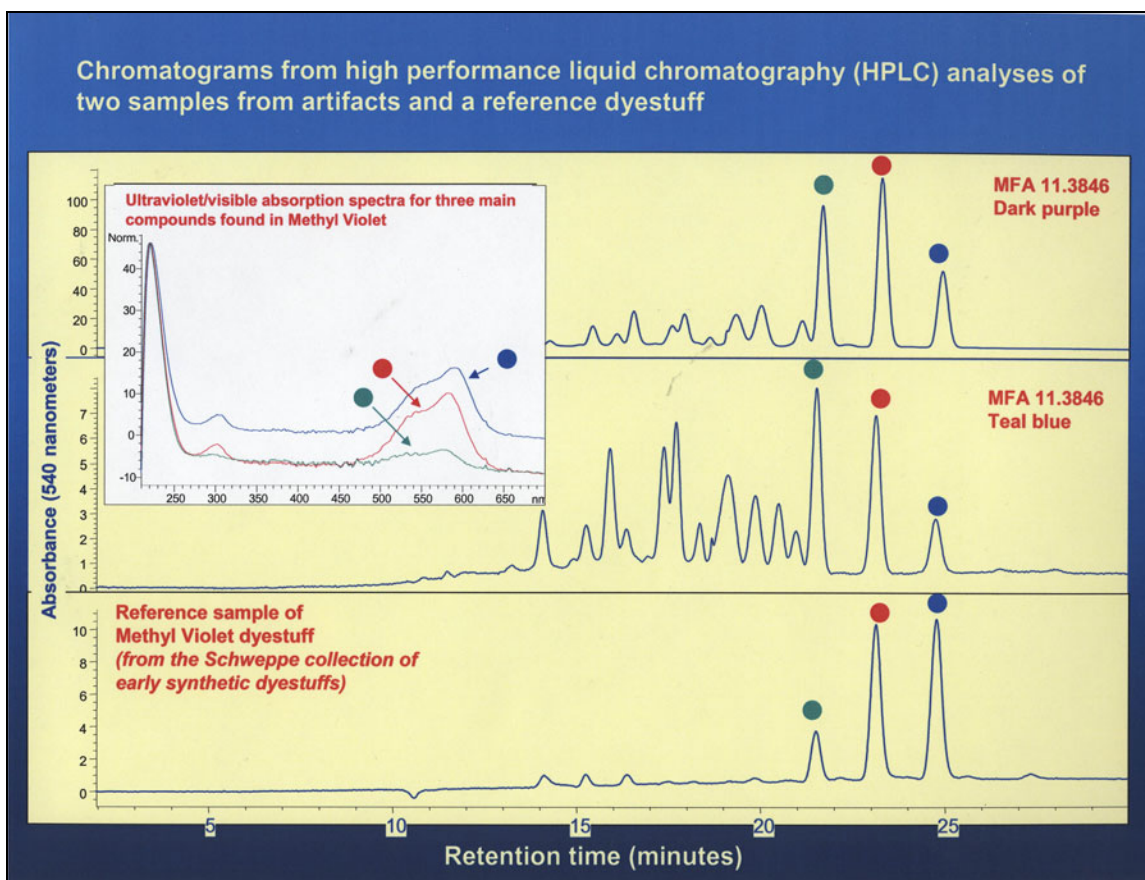


Fig. 7 Chromatograms comparing HPLC analysis of methyl violet and the dark purple and teal blue silk of MFA robe 11.3846.

The HPLC tests have revealed that the Japanese silk dyers adapted chemical dyes to their existing traditions. Instead of simply choosing another available color from the range of synthetic dyes available, the dyers continued to mix new colors using a single dye source—still creating much from little. However, while the dyers used synthetic dyes as an additional tool in their work, the dyes themselves created colors that came to symbolize the “modern” Japanese state. Textiles woven for official and ceremonial use, such as those made for the Imperial Palace in Tokyo as well as Buddhist temples, and even Noh theater costumes incorporated the synthetic dyes as a political statement. The “colors of progress” came to symbolize the modernization of Japan and its growth as a world power.

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